

REMARKS

The Office Action dated June 20, 2003, has been received and carefully noted. The amendments made herein and the following remarks are submitted as a full and complete response thereto.

Claims 2, 5 and 6 have been amended. The Abstract of the Disclosure has been amended as well. Applicants submit that the amendments made herein are fully supported in the specification and the drawings as originally filed, and therefore no new matter has been added. Accordingly, claims 1-6 are pending in the present application and are respectfully submitted for consideration.

Claim 1 was rejected under 35 U.S.C. § 102(b) as being anticipated by Carobolante et al. (U.S. Patent No. 5,656,897, hereinafter "Carobolante"). Applicants respectfully submit that claim 1 recites subject matter that is neither disclosed nor suggested by the cited prior art.

Claim 1 recites a PWM motor driving device that controls an amount of electric power supplied to a motor by controlling an ON/OFF duty factor of an output transistor connected between a power source and the motor. The PWM driving device includes a phase detecting means for detecting, among a plurality of phases of the motor, a phase which is currently being driven by the output transistor, and a saturation preventing means for performing control according to a voltage of the phase detected by the phase detecting means in such a way that the output transistor is not saturated.

Accordingly, at least one of the essential features of the present invention is a saturation preventing means for performing control according to a voltage of the phase detected by the phase detecting means in such a way that the output transistor is not

saturated. As such, the present invention results in the advantage of achieving enhanced motor rotation characteristics by preventing saturation of output transistors.

It is respectfully submitted that the prior art fails to disclose or suggest the elements of the Applicants' invention as set forth in claim 1, and therefore fails to provide the advantages which are provided by the present application.

Carobolante discloses a motor drive system, and method for operating the same, which includes current mirror load current sensing. The motor system of Carobolante operates in a bipolar mode on startup, and in a unipolar mode during full speed operation. In unipolar mode, a current mirror transistor is provided to sense the load current through the center tap drive transistor in a continuous manner. Ripple in the sensed current is avoided, as the center tap drive transistor is not commutated during motor operation in unipolar mode. In bipolar mode, current mirrors are provided for both of the high side and low side drive transistors in each leg, with the currents summed for each coil at a sum node, and with the summed current applied to a cumulative sum node; the summed current never drops to zero, as only one drive transistor changes in each phase change in the commutation sequence.

Applicants respectfully submit that each and every element recited within claim 1 is neither disclosed nor suggested by Carobolante. In particular, Applicants submit that the PWM motor driving device as recited in the present application is clearly distinct from that which is illustrated by the combination of the cited prior art. Specifically, it is submitted that the cited prior art fails to disclose or suggest at least the limitations of a "phase detecting means for detecting, among a plurality of phases of the motor, a phase which is currently being driven by the output transistor; and [a] saturation preventing

means for performing control according to a voltage of the phase detected by the phase detecting means in such a way that the output transistor is not saturated"

Applicants submit that the present invention relates to a PWM motor driving device that controls an amount of electric power supplied to a motor by controlling an ON/OFF duty factor of an output transistor. By contrast, the cited reference does not disclose or suggest a control by PWM (pulse-width modulation). Specifically, Carobolante does not disclose at least a PWM control means corresponding to switches 24-26, Fig. 2, of the present application. Furthermore, in column 5, lines 20-21, Carobolante describes a case in which a coil selection signal is shut off by some command or reason. However, Applicants submit that such showing is neither comparable nor analogous to each and every element recited in claim 1 of the present application.

In addition, the present invention achieves enhanced motor rotation characteristics by normalizing the saturation preventing function of the output transistors and by detecting accurately a phase being driven from among a plurality of phases of the motor even if the ON/OFF duty factor of the output transistors is controlled by PWM. In contrast, Carobolante detects a load current, reduces susceptibility to commutation transients, and applies the technology to a motor driving device having both unipolar and bipolar modes (column 3, lines 5-13). It is, therefore, submitted that each and every element recited in claim 1 of the present is neither disclosed nor suggested by the cited prior art, and therefore claim 1 is allowable.

Claims 2-6 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. In making this rejection, the Office Action appears to take the position that the function of the upper and lower saturation means is unclear. Claims 2, 5 and 6 have been

amended to more clearly recite the subject matter of the claimed invention. As such, Applicants submit that the amendments places claims 2-6 in compliance with US patent practice.

In view of the above, Applicants respectfully submit that each of claims 1-6 recites subject matter that is neither disclosed nor suggested in the cited prior art. Applicants also submit that this subject matter is more than sufficient to render the claims non-obvious to a person of ordinary skill in the art, and therefore, respectfully request that claims 1-6 be found allowable and that this application be passed to issue.

If for any reason, the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact the Applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper has not been timely filed, the Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension, together with any additional fees that may be due with respect to this paper, may be charged to counsel's Deposit Account No. 01-2300, **referencing docket number 103213-00044**.

Respectfully submitted,

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Enclosures: Petition for Extension of Time (One month)

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